Editorials

Wood & Other Renewable Resources: A challenge for LCA

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Sustainability

It began with an open fire to generate warmth, roast game and keep away wild animals. Since these early days of mankind, a lot of chapters have been added to the story of man and wood as well as other renewable resources. One of the most important chapters is about **sustainability**. Way back in the 18th century, a long time before sustainability became a political issue on the global agenda, the principle of sustainability was developed to safeguard the continuous wood supply to shipyards as well as ore and silver mines. In the year of 1713, *von Carlowitz*, for the first time, put into words that wood and other renewable resources have to be managed in a sustainable way to safeguard the continuous supply. Of course, since then the narrow definition of the sustainability principle has been extended. Environmental, economic and social dimensions have been added and quite many instruments are in place to measure these different dimensions. LCA is one of them (see below).

Innovation

First, let us continue to have a quick look into other chapters of the story. One is about **innovation**. Wood is one of the most versatile raw materials. The range of products based on wood is almost infinite. This is a result of innovation. All of us use wood-based products such as paper, tissues, card board containers, newspapers many times a day. In addition to these well-known products, however, there are many unknown products like food flavours made from wood, highly compressed wood used as underbody of Formula 1 race cars, or bullet security panels, chemicals, pharmaceuticals and many more. Innovation is going on and new products are introduced permanently. Our houses have at least a roof construction made of wood. Or they have wooden window frames, or are entirely made of wood like many houses in Northern Europe, North America and Australia. The rooms inside our houses are decorated with furniture made of sawn wood and veneer or derived wood products like particle board and medium density fibreboard. They have wooden doors and perhaps laminate or parquet flooring. Not to forget the **open fireplace** or a central heating fed with fuelwood. Here we are, back again, where the story has begun. Simultaneously, this is the beginning of another chapter.

Biomass, important source for Renewable Energy

Political decisions to mitigate climate change as well as increasing prices for fossil fuels in many industrialized countries has recently led to a renaissance of biomass as a fuel. In Europe, biomass is the most important source for renewable energy. On a global level, almost 50% of the harvested wood is used as energy source, and the demand is increasing. Hence, the most efficient conversion into energy is a key issue. The technical means to convert biomass into energy are manifold. One option is to produce heat and/or electricity by direct combustion. That can be very efficient from an energetic and environmental point of view. The conversion of biomass into a synthesis gas, slurry or liquid (RME, ethanol, cellulose ethanol, Fischer-Tropsch Diesel, etc.) is a second option. But how is their efficiency and environmental performance? These questions need to be answered.

Renewable resources and sustainability, renewable resources and innovation, biomass and energy, these are (only) three chapters in the focus of political, societal and scientific discussions. Actually, there are many more involved, but these three issues alone provide a good impression of the wide range of possible applications of renewable resources and hence the wide range for using LCA. Since many renewable resources originate from an intense amalgamation of biological and technical processes, there exists a large potential for case studies and methodological papers.

The Linkage to Land Use Impacts

The production of wood and agricultural crops can be found in wide areas of our environment; and, therefore, impact assessments of renewable resources and assessments of land use impacts belong together. This is an important connection and refers to the recently opened subject area 'Land Use in LCA' (Milà i Canals 2007, Milà i Canals et al. 2007a, Milà i Canals et al. 2007b, Koellner and Scholz 2007).

Acknowledgement and Call for Papers

Since the establishment of the subject area 'Wood & Other Renewable Resources' in 2005/2006, the number of submissions did increase remarkably (Hischier et al. 2005, Nebel et al. 2006, Rivela et al. 2006). This issue presents three papers (Werner et al. 2007, Gustafsson and Pål 2007, Rivela et al. 2007), and further articles are successfully under review in the ESS.

In this connection it is my pleasure to express my appreciation to **Dr. Barbara Nebel** (Nebel et al. 2006) and **Dr. Frank Werner** (Werner et al. 2007, Hischier et al. 2005) who both have agreed to support this subject area as Associate Subject Editors. They may wish to introduce themselves in a separate Editorial where they can also cover the issues beyond this subject area they may want to contribute in their function as Editors.

The Editors would like to thank you, our Authors! For us this is a clear vote to continue. We look forward to receiving further submissions in this area. Possible topics could be:

- Case studies of products based on renewable resources
- Case studies of bioenergy generation and biofuels (e.g. second-generation biofuels)
- Comparative assessments of products based on renewable and non-renewable resources
- Comparative assessments of bioenergy and non-renewable energies
- Life cycle engineering of new and innovative products based on renewable resources (e.g. wood-plastic or wood-carbon composites)
- Assessment of renewable resources with a special focus on land use
- Methodology development, particularly to solve system boundary issues when comparing renewable with non-renewable or biofuels with fossil fuels
- Assessments with a special focus on the biological production systems of renewable resources

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Upcoming (OnlineFirst)

Wooden Building Products in Comparative LCA: A Literature Review

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Background, Aim and Scope. We revised the results of approx. 20 years of international research on the environmental impact of the life cycle of wood products used in the building sector compared to functionally equivalent products from other materials.

Main Features. Original studies as technical reports or scientific papers in English or German are revised. This literature was obtained via an extensive literature review (February 2006), via the consultation of compilations of life cycle assessments (LCA) of wood products (e.g. elaborated during the COST action E9) or taken from secondary literature. The resulting list of literature is considered to be rather complete and covers the most relevant original comparative LCA studies of wood products in the building sector in Europe, Northern America and Australia. The documentation of the studies differs considerably in terms of completeness (life cycle stages included, assessment methods), transparency (description of methodological assumptions, characteristics of the products, available data, etc.) and scientific rigor (e.g. related to the functional equivalency). All encountered original studies are cited and their scope and transparency is shortly described. For the environmental ranking of wood products compared to functionally equivalent products, only quantitative, transparently described studies with no obvious methodological flaws are included, preferably covering the whole life cycle and conducted according to the ISO series of standards 14'040ff. For the assessment, the contribution of each product to an impact category is compared to the mean of all products included in a study.

Results. Among the most important results are: fossil fuel consumption, the potential contributions to the greenhouse effect and the quantities of solid waste tend to be minor for wood products compared to competing products; impregnated wood products tend to be more critical than comparative products with respect to toxicological effects and/or photosmog depending on the type of preservative; incineration of wood products can cause higher impacts of acidification and eutrophication than other products, whereas thermal energy can be recovered; although composed wood products such as particle board or fibreboard make use of a larger share of wood of a tree compared to products out of solid wood, there is a generally very high consumption of fossil energy associated with the production of fibres and particles/chips as well as with the production of glues, resins, etc.

Discussion. In LCAs of whole buildings, the materials used outside the areas of applicability of wood dominate the environmental profile of the building; current methods used for the impact assessment do no allow one to consider (also favourable) impacts of forests, such as land occupation, impacts on biodiversity, purification of air, etc.

Conclusions. Wood products that have been installed and are used in an appropriate way tend to have a favourable environmental profile compared to functionally equivalent products out of other materials. For the dispersion and application of these insights, it is necessary to adapt LCA to a form, which can be used on a regular basis for the decision making of different actors in the construction sector.

Perspectives. LCA methodology in general (the series of standards ISO 14'040ff) and for the environmental assessment of wood products have developed and been consolidated considerably in Europe and Northern America during the last decade; the more and more representative and reliable LCI data for wood products and competing products has become available. For a future use of the environmental value of wood products within a sustainable development, the general perception of the beneficiary use of wood products has to be increased at the various stages of decision-making.